EVOLUTION OF A HOSPITAL INFORMATION SYSTEM

Neilson S. Buchanan, Associate Administrator

El Camino Hospital, Mountain View, California 94040

ABSTRACT

The nature of this paper is experiential, not scientific. During the past 8 years many people have visited El Camino Hospital to observe the technical features of the information system and to learn about the organizational issues associated with the installation and operation of the system. This paper will review the key organization issues that have been of most interest. El Camino Hospital's experience is about the introduction of change. In most respects the changes at El Camino Hospital have direct applicability to any organization considering a comprehensive computerized information system.

Since 1965 El Camino Hospital has been deeply involved with a comprehensive hospital information system. For the first 6 years this involvement was limited to systems planning and development by the Hospital, its Medical Staff, Lockheed Corporation and later Technicon Corporation. In 1972 the information system became operational and today El Camino Hospital is usually regarded as the most experienced hospital in the world with computerized information systems.

This paper will explore the hospital and medical staff involvement - past, present and future - with the information system.

The setting is a 464-bed acute community hospital located on the southern end of the San Francisco Bay Peninsula. El Camino Hospital serves as the primary hospital for approximately 200,000 people. The community is relatively affluent and well-educated with the electronics industry as the predominant employer. The hospital currently operates on a budget of $50 million and provides almost all medical and hospital services. Outpatient services are relatively minimal. There are no medical school teaching affiliations nor is medical research conducted at the hospital. The vast majority of the medical staff is in private practice with the exception of the traditional hospital-based physicians. The hospital management and medical staff has been unusually stable over the past 15 years. Management Engineering, Nursing Service and Administration have been exceptionally strong divisions within the hospital during the past 10 years.

To best understand the progression of events over the past 15 years one should consider the following four time periods:

Period I 1965 - 1972: System Planning and Design.

Period II 1973 - 1974: System Implementation and Development.

Period III 1974 - 1979: First Contract and System Refinement.

Period IV 1979 - 1984: Second Contract and Future Planning.

Four basic principles have endured through each of these periods. These principles were adopted in 1965 by Administration, Medical Staff and the Board of the Hospital, and 15 years of experience has not required any modification whatsoever.

First, success is defined as a cost-effective system that enhances quality of care.

Second, the total understanding and commitment of the medical staff and all hospital personnel is required to implement such a system.

Third, to be successful the system must be practical for professional and non-professional users, especially physicians and registered nurses.

Fourth, a move to a computerized information system is a long-term and permanent change in the way nursing and medical care is provided in a hospital. The Technicon Medical Information System (TMIS) is a real-time inpatient-oriented information system providing a communications throughout the hospital. For the physician and nurse, the system is primarily an order-input and result-reporting service. The system provides other benefits such as organizing and reformatting clinical data. Certain work is organized and scheduled for the nurse. Approximately 57 video matrix terminals with light pens and 36 printers are in the hospital.

Departments, such as Laboratory, Radiology and Pharmacy, receive orders, work requests and forms through the system. These departments also report

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most results back to nursing units (i.e., patient records) through the system. Detailed description of the system can be obtained from references at the end of this paper or from a site visit to any of several installations throughout the United States.

A financial system also automatically posts most charges (i.e., when a nurse light-pens a scheduled medication as "given", the medication unit dose is automatically charted and charged). Routine accounting, payroll, patient billing and management reports are also provided.

Period I 1965 - 1972: System Planning and Development

During this period, system analysts and hospital clinical personnel developed operating specifications for the system. The need to change work methods was openly discussed and planned. Cost/benefit studies by hospital personnel identified cost savings and potential implementation problems. Cost-savings were generally found in the areas of work elimination and simplification. Another important area was cost-avoidance. Job security was repeatedly assured by explaining attrition would be used to achieve labor savings. Despite good planning, most personnel during this period felt that the system was always "somewhere out there in the future". This attitude was to become more apparent in Phase II. In retrospect, however, it is clear that four groups did understand the future implications of the system - Nursing Service, Management Engineering, a Medical Staff Steering Committee and Administration. The commitment of these four groups was the key to success during the next period.

Period II 1973 - 1974: System Implementation and Development

Because El Camino Hospital was the first hospital to install a comprehensive information system, the hospital personnel and medical staff had to endure two major problems. By early 1973 the hospital had installed terminals throughout the hospital and abandoned most traditional paperwork. Hospital personnel and physicians soon found themselves trying to work in a new environment with a "computer" that was functioning basically as anticipated. However, to make matters interesting, the "computer" also was misbehaving by failing to function on occasions as well as "doing" certain tasks that no one understood. It is a fair statement to say that no person at El Camino Hospital would like to relive those initial problems of the system.

Significant medical staff problems developed. A large vocal minority (30-40%) of the medical staff were initially dissatisfied. Causes of dissatisfaction during this time were in the following priority:

1. Legitimate complaints due to system nonperformance and/or poor design.
2. Reaction to change from long-established, ritualistic work methods.
3. Discomfort caused by disruption in the traditionally placid working environment at El Camino Hospital.
4. Inability to learn new techniques.

Obviously, these four factors varied among physician groups and, ironically, it was not unusual to identify physicians who were extremely dissatisfied, yet were enthusiastic advocates.

Nursing, laboratory, radiology, pharmacy, accounting and admitting personnel were also profoundly affected during this period. No major problems ever developed. Nursing personnel were particularly affected by new nursing procedures, the need to achieve labor savings and the turmoil with the medical staff. Nursing personnel often became subtle teachers, or coaches, to certain physicians so that they could learn how to use the system. Management Engineering and Technicon personnel worked tremendously hard to identify problem areas and implement solutions. Finally, credit must be given to the Administrator who supported continuance of the system. It is also important to realize that during the worst turmoil there was never a retreat in pulling the system back. There were, however, several periods when implementation was held static while improvements and further training was accomplished.

Throughout 1973 considerable effort was undertaken to refine the basic operating features of the system. Sub-systems such as laboratory test scheduling, I.V. ordering and pharmacy needed improvement in order to be acceptable. In other cases certain physicians could not and did not change from the traditional medical records and interaction with nurses. Problems with laboratory, food service and other departments were evident, but much less acute and devisive than physician problems.

There are four important lessons to be learned from this experience. First, nursing understanding and support is critical. Nursing support can be used to overcome many physician problems. Second, physician training is difficult at best, and a hospital should use its best imagination in designing a physician training program. Other hospitals have learned from the El Camino experience and have done commendable jobs in obtaining physician understanding and support. Third, the difficulty of implementing an unproven system cannot be underestimated, particularly when there are no role-models to call upon. Fourth, a strong and imaginative management team (i.e., Administration and Department Heads) is needed to implement the complex change represented by the computer system.

Period III 1974 - 1980: First Contract and System Refinement

During the previous 2 years many system inadequacies had been perfected and, in particular,

the nursing service had become an enthusiastic supporter. A smaller minority of the medical staff still felt that the system should be discontinued. Unfortunately, many of their criticisms were based on attitudes and hard feelings from Period II. The system's performance was greatly improved and by mid-1974 a majority of the medical staff did feel that the hospital should continue with the system. It is interesting to note that most new physicians joining the medical staff learned the system quickly. During the development stages prior to August 1974 El Camino had determined its payments to Technicon on the basis of realized cost-savings to the hospital. The savings had become significant enough by August 1974 that Technicon and El Camino negotiated a 5-year contract for services. Although there were some variable costs in the contract, the cost to the hospital was basically fixed. During this contract Technicon was to make certain basic improvements at no cost and El Camino agreed to pay the development costs of non-basic enhancements.

During 1975 and 1976 system improvements created greater and greater acceptance. By 1979 over 80% of all possible physician orders were being entered directly by the physicians themselves. One of the biggest probems was that new and worthwhile changes could not be implemented fast enough. An additional problem was responding to requests that were "nice to have" but not cost-effective. Clinically-oriented personnel showed an uncanny ability to create the need for sophisticated sub-systems that had limited applicability to the more generalized information system.

Finally, it should be noted that management personnel at El Camino had become quite accustomed to implementing change. As a result, unrelated changes such as organization changes were made with increased ease. The synergistic effect of the system provided many management opportunities to lower costs and improve care at El Camino Hospital.

Period IV 1980 - 1984: Second Contract and Future Planning

Major changes in the contract terms are anticipated for Period IV. The pricing structure of the second 5-year contract provides a major incentive for the hospital to provide its own data processing center. New VMT's and printers are being purchased by the hospital instead of long-term rental. A perpetual license for current and future software has been negotiated.

It is expected that cost-effectiveness will continue to be the primary emphasis in determining future enchancements. A quality assurance system using the real-time data base is being actively studied, and there is a possibility that physician office billings and its data base will be added. Patient acuity, patient scheduling and nurse staffing sub-systems will be developed and integrated. More distant in the future will be interfaces with patient monitors and other clinical mini-computer systems. Benefit realization from these areas will be one of the greatest challenges yet to come. As new HMO's, prospective rate setting and cost containment become realities in California, the financial and management information package will have to be improved to meet the hospital's needs.

Conclusion

The 15-year experience at El Camino Hospital demonstrates the viability of comprehensive computer information systems. Furthermore, it is widely recognized that computers will play a significant role in the labor-intensive hospital industry throughout the 1980's. Decreasing computer costs and increasing labor costs will lead hospitals to automate many functions. The challenge for hospitals will not be identifying these functions for computer applications. The real issue is how well-prepared is hospital management to achieve the cost-savings and quality enhancements that are inherent with computers.

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